TRI-LAB SURVEY OF SOFTWARE ENGINEERING PRACTICES IN THE ACCELERATED STRATEGIC COMPUTING INITIATIVE

IMPLEMENTATION PLAN

DOCUMENT REVISION SHEET

Issue & Date	Section	Changes:
01 25 January 1999	All	Initial Release

Revisions to this Implementation Plan will be incorporated in future releases as necessary.

Foreword

In December of 1998, Gil Weigand requested that I lead an effort to conduct a Tri-Lab Survey to baseline the software quality practices of the Accelerated Strategic Computing Initiative. This Implementation Plan constitutes one of the major deliverables of the tri-lab effort, and represents input from each of the three ASCI laboratories, plus INEEL.

Prior to Gil's request, I had already initiated activities with Maysa Peterson at LANL to conduct such a survey of select code teams at Los Alamos. I had also made a single trip to LLNL to report on what we were doing at Sandia and Los Alamos. During previous years, the Software Team within our Quality Engineering Department had conducted numerous such surveys or software process assessments based on SEI's Capability Maturity Model, both within Sandia as well as in numerous external hi-tech engineering companies. In these efforts and in cooperation with SEMATECH and SEI, we evolved an extensive infrastructure of materials and tools for planning, training, data gathering and analysis, and reporting. The challenge lay in applying these resources within the ASCI program, and with full cooperation of all three ASCI labs.

The technical work of adapting the software engineering assessment process to this survey was modest, but the work of identifying the specific tri-lab issues and problems, and of fashioning appropriate solutions for them, was significant. Considerable time was spent, both at the Training Session and with individual code teams and leaders, to explain what this survey is and is not, and how the ASCI code teams should gain more from this activity than anyone else.

We are strongly indebted to managers and staff members at all three laboratories who demonstrated their dedication to the successful accomplishment of this survey. Their cooperation and contribution to preparing this implementation plan have been indispensable to its viability. Their continued involvement and support are necessary to its achievement.

The working group of contributors to this plan included many individuals, but special recognition is due the following:

INEEL	Dennis Adams, Nyle Brown
LANL	Maysa-Maria Peterson, Gerald Reisz
LLNL	Nancy Storch
SNL	Dwayne Knirk, David Peercy, Patty Trellue

When this plan was issued on January 25, 1999, the sponsoring ASCI V&V Executive Council had the following membership:

Bill Reed, Chair	DOE ASCI V&V Program Manager
Mike Jones	LANL ASCI V&V Program Manager
Cynthia Nitta	LLNL ASCI V&V Program Manager
Jaime Moya	SNL ASCI V&V Program Manager

This Tri-Lab Survey Implementation Plan is hereby released; the survey schedule is underway. Revisions to this Implementation Plan will be incorporated in future releases as necessary.

It is up to each of us to implement this effort as efficiently and smoothly as possible. Code teams should use the survey results to help identify true opportunities for improvement in their software engineering and quality practices. We should all take advantage of the successes of others to define a better implementation approach for ourselves. The individuals named in this Foreword stand ready to help in that effort in whatever way we can.

Michael A. Blackledge
25 January 1999

Preface

The conduct of this Tri-Lab Survey of Software Engineering Practices in the Accelerated Strategic Computing Initiative is a complex project. It requires extensive scheduling, logistics, training, travel, information management, and coordination of activities across three national laboratories. It also requires performing a software process assessment at each laboratory. Because of the number of organizations and the variety of individuals involved in this activity, as well as the geographical barriers to easy communication and coordination, a comprehensive plan for guiding this activity is required. This document serves as a working repository of information and references for the preparation and conduct of the Tri-Lab Survey.

The immediate purpose of performing software process assessments at each laboratory is to collect information about the current state of software engineering practices in the ASCI projects at those laboratories. A more important, long-term use of the assessment results is to help each laboratory and individual code team plan cost-effective software process improvements that will benefit both the code teams and the ASCI codes. The information provided from the assessment serves as a factual basis for focusing specific software process improvements toward issues having the greatest potential benefit for the ASCI program software products.

During the preparation of this implementation plan, it has been evident that code teams are proud and protective of the codes they produce. But they are also eager to share with their peers information about accomplishments and difficulties with various software engineering processes. Hopefully, the tri-lab collaboration fostered by this survey can expand into a tri-lab collaboration aimed at increasing the effectiveness of software engineering practices supporting ASCI work.

This implementation plan is organized into five principal parts. The purpose and content of each part is briefly described in the following paragraphs.

An **Executive Summary** summarizes the motivation for performing the survey, the primary requirements and constraints driving the implementation plan, and the planning approach used.

Section 1 states the purpose of the survey and identifies those factors most significant in determining whether the survey will be successful. The motivation for regarding the survey as part of the ASCI V&V Program activities is summarized. The scope of the survey is described in terms of activities, participants, and customers. Finally, several of the expected benefits to both the participants and the customers are identified.

Section 2 focuses on the upper level, multi-organization aspects of the survey. A more detailed explanation of the survey requirements is provided, and the approach to be followed for performing the work is outlined. Several significant issues to be respected in the implementation of the survey are identified, and their impact on the plan noted. The primary activities and responsibilities by which survey data will be collected, analyzed and reported are documented. Of particular importance in this section is an articulation of the policy for confidentiality, addressing both participant privacy concerns as well as

security concerns for encounters with classified information.

Section 3 focuses on the lower level, laboratory-specific aspects of the survey. A concise summary of the standard software process assessment process is provided. This summary includes an identification of the major activities and the responsibility for their performance. A generic schedule for the preparation, site, and follow-up work is also shown.

Appendix A contains a copy of the memo from Gil Weigand directing this work.

Appendix B contains current data specific to the upper-level of the plan.

Executive Summary

The Deputy Assistant Secretary for Strategic Computing and Simulation in the Office of Defense Programs in the Department of Energy has requested the conduct of a survey of software engineering practices currently used in the Accelerated Strategic Computing Initiative (ASCI). Work in ASCI is being performed by three national laboratories: Los Alamos National Laboratory, Lawrence Livermore National Laboratory, and Sandia National Laboratories.

The survey addresses the state of software engineering practices currently being applied toward ASCI objectives. The survey does not evaluate the personnel in the laboratories, it does not evaluate the scientific and computing technology base for ASCI, and it does not directly evaluate current ASCI codes. Rather, it evaluates the capabilities of the various software processes used for producing and evolving ASCI codes and compares them with current perceived difficulties in achieving each organization's desired goals. The survey will determine how well these software processes in ASCI are defined, managed, measured, and controlled.

Each laboratory is an equal partner in the survey project, providing a primary assessor (and one or more alternates) for the assessment team. This team conducts a software process assessment at each laboratory, following an industry-standard approach. The assessment uses three methods for gathering information about software engineering practices. First, each code team provides a self-assessment of their practices by responding to a standard questionnaire. Second, on-site interviews with each code team are conducted by the assessment team. Third, during the site visit to each laboratory, the assessment team also examines various project documents and materials as evidence of the various practices. The laboratories are individually responsible for their participation in the laboratory assessment and for providing on-site support for the assessment team's site visit.

Each code team receives a separate assessment report with analysis of the code team's processes in 13 key process areas. That report focuses on the software engineering practices currently used in relation to any problems currently encountered, and suggests process improvements that could most benefit the code team's work. Similarly, each laboratory receives an assessment report with an aggregate indication of the current state of software engineering practices among the code teams.

The tri-lab assessment team documents their survey results in a Tri-Lab Survey Report. That report is distributed to the DOE ASCI V&V Program Manager and the other members of the ASCI V&V Executive Council. It contains an aggregate indication of the current state of software engineering practices among all the code teams in the ASCI laboratories. The survey project is accomplished during the first half of CY1998.

Independent observers from Idaho National Engineering and Environmental Laboratory provide an assessment of the survey process itself. During the survey project, they will continuously feed back comments and suggestions to the assessment team for immediate improvement of the survey process. Later, they will analyze their observations and document their evaluation of the overall survey process in a separate Tri-Lab Survey

Assessment Report. That report is distributed to the DOE ASCI V&V Program Manager and the other members of the ASCI V&V Executive Council. It should be delivered concurrently with the Tri-Lab Survey Report.

Significant issues in planning this survey include using an appropriate survey population, minimizing the disruption of daily work, and maintaining the confidentiality of all participant information. Related laboratory-specific issues include appropriate classification reviews of assessment data and report sensitivity and markings.

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1. PROJECT STATEMENT

1. 1 Purpose of This Survey

The purpose of this survey is to establish a baseline understanding of software engineering practices being employed in the Accelerated Strategic Computing Initiative (ASCI) to support code management, development, and evolution activities. The goal is to document the needs of ASCI participants and to support future software process improvement activities as part of the implementation of the ASCI Validation and Verification (V&V) Program.

The survey addresses the state of software engineering practices currently being applied toward ASCI objectives. The survey does not evaluate the personnel in the laboratories, it does not evaluate the scientific and computing technology base for ASCI, and it does not directly evaluate current ASCI codes. Rather, it evaluates the capabilities[1] of the software processes[2] used for producing and evolving ASCI codes. The survey will determine how well these software processes in ASCI are defined, managed, measured, and controlled.

Each laboratory is an equal partner in the survey project, providing a primary assessor (and one or more alternates) for the assessment team. This team conducts a software process assessment at each laboratory, following an industry-standard approach. The assessment uses three methods for gathering information about software engineering practices. First, each code team provides a self-assessment of their practices by responding to a standard questionnaire. Second, on-site interviews with each code team are conducted by the assessment team. Third, during the site visit to each laboratory, the assessment team also examines various project documents and materials as evidence of the various practices. The laboratories are individually responsible for their participation in the laboratory assessment and for providing on-site support for the assessment team's site visit.

Several issues are significant in determining the success of this survey. This plan gives special attention to the following issues.

Survey population.

The goal of the survey is to include enough of the appropriate ASCI code teams to represent the actual state of affairs, not to force participation by all ASCI personnel. While every code team has an unhindered opportunity for participation in the survey, this plan provides for a laboratory-directed selection of participant code teams and representative staff members.

Disruption of daily work.

This survey project includes an assessment of selected code teams at

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1. Capabilities are the results to be expected from an organization. They depend on policies, methods, and tools available to ASCI code teams and used for producing the various application and infrastructure codes.

2. A software process consists of techniques, activities, plans, practices, procedures, documentation, and steps used to perform the production and maintenance of software.

each laboratory. These assessments have been practiced and documented by the software engineering process community for nearly a decade, and consequently have become quite time-efficient.

An assessment requires varying amounts of time from various participants. Members of an Assessment Team (A-Team) spend some weeks of dedicated time before, during, and after the on-site work. Only the Site Coordinator at each laboratory would spend a comparable amount of time.

The effort required for code team personnel is much less. One or more members of the participating code teams may spend a few days preparing responses to the standard questionnaire and gathering process evidence before the site visit. However, during the period when the A-Team is on site, participating code team personnel and management personnel have a commitment of only about four hours per person.

Confidentiality of participant information.

Individuals at all technical and managerial levels are encouraged to provide complete and candid information and evidence of software practices. Full and accurate information can be extremely difficult to acquire if individuals feel their contributions may be ignored or misused against them individually. The process for conducting this survey places very strict confidentiality controls on all survey information received by the A-Team and reported by the A-Team. Written agreements are signed by each A-Team member to guarantee confidentiality to all participants. (Some information may also be protected by security classification.)

1. 2 Background for This Survey

The mission of the Accelerated Strategic Computing Initiative (ASCI) is to provide validated, science-based, engineering solutions across the product life cycle to meet the mission needs of stockpile stewardship.

The ASCI program is accountable to DOE for maintaining the engineering mechanics and scientific disciplines and associated computational and experimental technologies and assets required for making sound engineering decisions. The computer technology and products developed in ASCI will be applied to a broad spectrum of national needs as well as to the stockpile stewardship mission.

In particular, the ASCI program participates with weapons designers in support of the DOE Stockpile Stewardship and Management Plan developing advanced computational and experimental tools that enable the continuing certification and assessment of weapons systems in the enduring stockpile.

The operational capabilities to be provided by the ASCI program comprise advanced hardware and software systems. Because of the high consequence of errors or failures in these capabilities, verification and validation are major undertakings of great import. As part of the ASCI Validation and Verification Program activities, the Deputy Assistant Secretary for Strategic Computing and Simulation in the Office of Defense Programs in the Department of Energy has requested, and is sponsoring, a survey of software engineering practices in ASCI.[1] The survey covers the ASCI work at three national laboratories: Los Alamos National Laboratory, Lawrence Livermore National Laboratory, and

Sandia National Laboratories.

Inasmuch as ASCI encodes a knowledge base of all relevant weapon physics, component engineering, and full scale testing practices into a substantial body of computational facilities, then effective and trusted software engineering practices are a foundation for the successful management, development, and evaluation of the ASCI capabilities.

1. 3 Scope

This survey is intended to focus on the technical and managerial practices affecting all computational physics codes and selected support codes. The Site Coordinator for each laboratory assessment will work with that laboratory's ASCI V&V Executive Council Representative to select the code teams to participate in the assessment.

All ASCI programs and code teams at the Lawrence Livermore, Los Alamos, and Sandia laboratories are eligible to participate in the baseline survey. Sandia will take the lead in ensuring the program is implemented. Each laboratory will be an equal partner in the survey program and will provide participants for the Assessment Team. Idaho National Engineering and Environmental Laboratory (INEEL) will observe the individual laboratory assessments and serve as an independent assessor of the survey process.

The survey result is more than a description of the current state of affairs. It actually provides the following:

Analysis, comparison, and fusion of questionnaire responses, code team interviews, and reviews of documentation and other evidence to form objective, substantiated conclusions about current software engineering practices in code teams, in laboratories, and in ASCI;

Assessment of observed practices with respect to the Software Engineering Institute's Capability Maturity Model for software processes [*1,2*][1]; and

Recommendations for process improvements likely to have the greatest benefits for increasing software engineering capabilities in ASCI.

Software process assessments of the kind used in this survey are traditionally the first step of a structured program for software process improvement in an organization. The assessment identifies current capabilities of the organization and compares them with current perceived difficulties in achieving the organization’s desired goals. Shortcomings are targeted in process improvement projects. Such improvement programs are outside the scope of this survey. Nevertheless, the various Assessment Reports produced by the Tri-Lab Survey project are intended to serve exactly as that first step for each code team and each laboratory. A structured program of software process improvements in each code team individually and in each laboratory collectively would be the logical follow-on activity for extracting the most value from this survey. Quality engineering and process improvement personnel within each laboratory are the appropriate leaders and/or supporters of those programs.

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1. A copy of the memo from Gil Weigand directing this work is provided in Appendix A.
1. In this document, numbers in brackets are references to materials listed in Section 1.8.

1. 4 Benefits

The survey will provide benefits to the Office of Defense Programs, ASCI Program management at each of the Laboratories, and individual code teams contributing to ASCI.

The survey is designed to support the seamless management of ASCI as "three labs, one program." It supports the development and the verification and validation of ASCI codes. It involves all three laboratories as equal partners in the assessment process. It uses an objective reference model of software engineering practices. It applies that model uniformly across those laboratories for cataloging the extent and rigor of software engineering practices currently needed in the ASCI program.

The survey is designed to support each participating code team by identifying the practices already in use and the possible opportunities for further improving practices to make the code team yet a more effective organization for producing better quality codes.

Building on the strengths of current practices, an organization may work toward any number of specific objectives such as

- increased product confidence,
- reduced overall cost,
- shortened time to delivery,
- improved supportability and reuse of software products,
- higher productivity of the skilled domain experts, and
- less reliance on individual experts and better dissemination of individual knowledge.

The significance of any process improvement is how it affects the various quality factors of ASCI code products. Thus, before embarking on a particular process improvement project, care is needed to decide what kind of changes in which quality factors will define the “success.” of the effort. All process improvements projects should be performed in the context of a business case for the values expected to be realized. Proposed improvements that do not have a good business case should probably not be undertaken.

It is generally true that the larger the code team, the more significant are the effects that software engineering processes can have on the quality of the code product. Processes become more important to reduce the number of defects created in the code, to increase the effectiveness of defect detection and removal throughout the development cycle, and to increase the comprehensiveness of testing for all intended functionality, for all coding structures, and for all “most probable errors.”

For example, if ASCI codes are developed without sufficient attention to software engineering practices, they are likely to contain software defects that not only contaminate the interpretation of model results, but also may be perceived mistakenly as modeling defects. Worse, it is possible for software defects to be subtle, yet have catastrophic consequences [*7*]. The results of software are not constrained by any physical laws of continuity, and in a some contexts, an incorrect bit can destroy all meaning in results. Without evidence

of rigorous development discipline and comprehensive verification, it is simply not possible to validate such code effectively for any predictive use. Quantitative testing objectives, as well as practices for software defect prevention and removal, raise the credibility that new applications of codes won't produce results tainted by previously undiscovered software defects

1. 5 Acronyms

ASCI	Accelerated Strategic Computing Initiative
A-Team	Assessment Team
CMM	Capability Maturity Model for Software [*1,2*]
FAR	Functional Area Representative; may be staff members, project leaders, or program managers representing the technical and managerial practices in an organization
INEEL	Idaho National Engineering and Environmental Laboratory
LANL	Los Alamos National Laboratory
LLNL	Lawrence Livermore National Laboratory
SNL	Sandia National Laboratories
SEI	Software Engineering Institute
V&V	Validation and Verification, as given in the Program Plan (Version 2.5) for the Strategic Computing & Simulation Validation & Verification Program [*6*] (*Normally: Verification and Validation.*)

1. 6 Deliverables

The Tri-Lab Survey project produces the following deliverables.

Code Team Assessment Report. A report summarizing a code team's process assessment results. A Code Team Assessment Report is prepared for each participating code team.

Laboratory Assessment Report. A report aggregating the code team assessment results across a laboratory. A Laboratory Assessment Report is prepared for each ASCI laboratory.

Tri-Lab Survey Report. A report aggregating the assessment results from all three ASCI laboratories. The Tri-Lab Survey Report is prepared for the ASCI program as a whole.

Tri-Lab Survey Assessment Report. A report summarizing the performance of the tri-lab survey process and evaluating the credibility and usability of its conclusions.

1. 7 Roles and Responsibilities

Responsibilities and actions in the body of this plan are assigned to *roles*.

Distinct groups of roles can be distinguished by their scope of activity and source of staffing.

Assessment team roles participate in activities across the ASCI laboratories, and their staff is drawn from all ASCI laboratories. These roles include **Lead Assessor**, **Primary Assessor**, **Alternate Assessor**, and **Assessment Team**.

A **Process Observer** role attends activities across the ASCI laboratories, and the staff is drawn from outside the ASCI laboratories.

Laboratory assessment roles participate in activities in a single laboratory, and their staff is drawn from that laboratory. These roles include **Site Coordinator** and **ASCI V&V Executive Council**.

Assessment participant roles participate in some of the activities in a single laboratory, and their staff is drawn from that laboratory. These roles include **Code Team Lead** and **Code Team Staff**.

The following tables define these roles in terms of their primary activities and responsibilities. The implementation schedule in Appendix B includes specific assignments of roles, dates, and locations.

Lead Assessor	The assessor responsible for planning, leading, organizing, directing, conducting, and closing all laboratory assessments. Is a highly qualified assessor. Holds and protects all confidential information. Responsible for preparing all assessment deliverables, as well as the Tri-Lab Survey Report.
Primary Assessor	A person appointed by an ASCI V&V Executive Council Representative to serve on the Assessment Team. Must satisfy qualifications for being an assessor. Must be trained in the mechanics of the Tri-Lab Survey and the CMM-based assessment method [*4,5*]. Participates in all laboratory assessments. Conducts interview sessions, reviews samples of project materials. Supports Lead Assessor in analysis and evaluation of assessment observations and in production of assessment reports.
Alternate Assessor	A person who is trained in the mechanics of the Tri-Lab Survey and the CMM-based assessment method [*4,5*] and qualified to substitute for a primary assessor. Each laboratory appoints one or more alternate assessors.
Assessment Team (A-Team)	Team of assessors who perform laboratory assessments. Produces Code Team Assessment Reports, Laboratory Assessment Reports, and the Tri-Lab Survey Report. Normally, the Lead Assessor and the three Primary Assessors compose the A-Team. Alternate Assessors may substitute for Primary Assessors for a particular laboratory assessment.

Process Observer	INEEL staff member who observes and evaluates each laboratory assessment. Evaluates the survey process. Produces the Tri-Lab Survey Assessment Report.

Site Coordinator	Laboratory staff member who works with the Lead Assessor for planning and conducting a laboratory assessment. Responsible for all site logistics, to include scheduling, facilities, equipment, and meals. Works with the laboratory's ASCI V&V Executive Council Representative for selecting the participating code teams. Works with participant code teams for responding to the standard questionnaire [*9*], selecting FAR group members, and collecting samples of project materials.
ASCI V&V Executive Council	The group of all laboratory ASCI V&V Program Managers, chaired by the DOE V&V Program Manager

Code Team Lead	Technical lead or project manager for a Code Team. Responsible for ensuring completion of the initial self-assessment of the team's software engineering practices [*9*]. Receives the Code Team Assessment Report.
Code Team Staff	Staff members in a laboratory group who collaborate on the development and delivery of software products for a particular ASCI functionality. Responsible for describing code team processes and activities in FAR group interview sessions.

1. 8

References

The following documents describe the approach, the methods, and the tools used by the Assessment Team for performing the laboratory assessments.

[1] Mark C. Paulk, Bill Curtis, Mary Beth Chrissis, Charles V. Weber, *Capability Maturity Model for Software, Version 1.1*, Technical Report CMU/SEI-93-TR-24, Software Engineering Institute, Pittsburgh, 1993

[2] Mark C. Paulk, Charles V. Weber, Suzanne M. Garcia, Mary Beth Chrissis, Marilyn Bush, *Key Practices of the Capability Maturity Model , Version 1.1*, Technical Report CMU/SEI-93-TR-25, Software Engineering Institute, Pittsburgh, 1993

[3] David Zubrow, William Hayes, Jane Siegel, and Dennis Goldenson, *Maturity Questionnaire*, Special Report CMU/SEI-94-SR-007, Software Engineering Institute, Pittsburgh, June, 1994

[4] Donna K. Dunaway, and Steve Masters, *CMM–Based Appraisal for Internal Process Improvement (CBA IPI): Method Description*, Technical Report CMU/SEI-96-TR-007, Software Engineering Institute, Pittsburgh, April, 1996

[5] Michael K. Daskalantonakis, “Achieving Higher SEI Levels,” *CrossTalk*, September, 1994

[6] *Strategic Computing & Simulation Validation & Verification Program: Program Plan, Version 2.5*, DOE Defense Programs Stockpile Stewardship Program, April, 1998

[7] James R. Lee, *Certainty in Stockpile Computing: Recommending a Verification and Validation Program for Scientific Software*, Sandia Report SAND98-2420, Sandia National Laboratories, November, 1998

[8] *Sofware Process Assessment: Project Profile Sheet*, Sandia National Laboratories

[9] *Sofware Process Assessment: Software Process Maturity Questionnaire*, Sandia National Laboratories

[10] *Sofware Process Assessment: Confidentiality Agreement*, Sandia National Laboratories

[11] *Laboratory Assessment Plan* (a template for planning individual laboratory assessments), Sandia National Laboratories

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2. PLAN FOR THE TRI-LAB SURVEY

2. 1 Requirements

The Tri-Lab Survey of Software Engineering Practices in the Accelerated Strategic Computing Initiative is a multi-level aggregation of software process assessments conducted at each of the three ASCI laboratories.

Michael Blackledge at Sandia National Laboratories has been designated as the survey leader. Each laboratory will be an equal partner in the survey project and will provide participants for the assessment team, as well as site support for laboratory assessments. Information for preparing the Tri-Lab Survey Report will be collected through software process assessments conducted at each of the ASCI laboratories. INEEL will serve as an independent assessor of the survey process and prepare a separate report.

Each ASCI program and each ASCI code team at LANL, LLNL, and SNL is eligible to participate in the survey.

2. 2 Approach

2. 2 1 Multi-level organization

The concept of operation for the Tri-Lab Survey facilitates planning in two distinct but coordinated levels. This document includes both levels of planning information.

The upper level of planning focuses on the multiple laboratory/site aspects of the survey, that is, on the extended activities, participants, responsibilities, resources, and schedules for achieving the delivery of the final survey report. The information in this survey is to be obtained from each of the three laboratories separately.

The lower level of planning focuses on a generic set of site activities to be conducted at a laboratory. Separate assessments will be conducted at each of the three laboratories for gathering the detailed information about their current software engineering practices.

2. 2 2 Information gathering and reporting

The Tri-Lab Survey has a variety of information sources and customers, to include ASCI code teams, Code Team Leaders, laboratory ASCI management, and DOE ASCI V&V Program Management. It is the responsibility of the Assessment Team to integrate correctly the raw data acquired from the various sources and to partition it properly into a set of final output reports. Each report contains an aggregation of certain raw data that has been analyzed appropriately for use by the customer of the report. The global information flows in this process, including the information sources and the report customers, are illustrated In Figure 1.

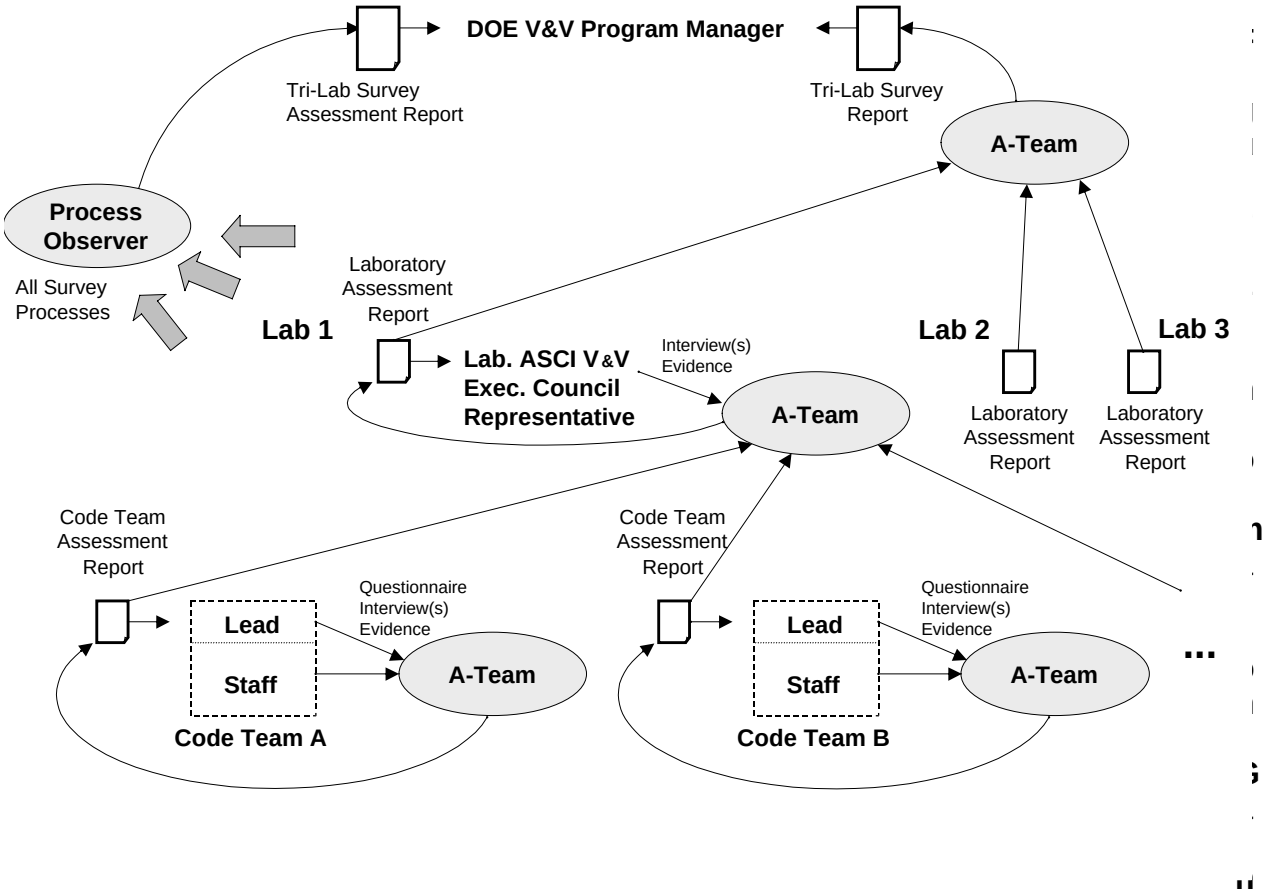

Figure 1. Information Gathering, Analysis, and Reporting Activities

At the lowest level, the Assessment Team (A-Team) collects information from participant code teams. Information is obtained in three forms: self-assessment responses by the code team to the standard questionnaire [*9*], interviews with selected members of participating code teams, and review of project evidence demonstrating current practice.

There are several results from the Laboratory Assessment.

Each code team receives a team-specific report of assessment results. Information from technical staff, technical leadership, and project management is aggregated into a Code Team Assessment Report that is delivered to the Code Team Lead.

ASCI V&V Program Management at the laboratory receives a laboratory-wide assessment report. This report aggregates and summarizes the kinds of assessment results found among that laboratory's code teams, but without attributing any particular results to any particular code team. Additional information obtained from laboratory program management about software quality requirements and programmatic constraints may also be used in this report. That information is combined with the code team assessments to produce an aggregate assessment of the laboratory.

Finally, DOE ASCI V&V Program Management receives the Tri-Lab Survey Report. This report aggregates and summarizes the kinds of assessment results found in the individual laboratory assessments, but without attributing any particular results to any particular laboratory.

Separately, DOE ASCI V&V Program Management receives the Tri-Lab Survey Assessment Report. This report, prepared by the independent process observer, evaluates the objectivity of the survey process, as it was conducted, and the credibility of the survey results.

2. 2 3 Information analysis

At each laboratory, the A-Team will use an assessment method based on the Software Engineering Institute's Capability Maturity Model (CMM) for software processes [*1,2*]. That model is a "staged reference model."

Reference model.

It is called a "reference model" because it is not a standard for specific practices; rather it is a model of capabilities that may be achieved by any number of different practices. The capabilities of an organization to produce software are defined by commitments (management focus and funding), abilities (investment in training and tools), accomplishments (work products), verification (successful use of the capability practices), and measurements that are to be found in the processes.

Staged.

It is called "staged" because it bundles software practices into ordered sets of capabilities. Each set implements a successive state of advancement in organizational growth. The sequencing of capabilities provides a roadmap for the introduction of new practices or practice improvements.

The CMM comprises 18 key process areas, organized into five capability levels. The laboratory assessments for the tri-lab survey only focus on the 13 key process areas in Levels 2 and 3 of that reference model. Although the CMM is organized by stages, those stages are *not relevant* to this survey. The survey team uses the CMM as a highly refined checklist of software process considerations, *not* as an evaluation scale. Using those stages as an evaluation scale would presuppose their acceptance in the domain of ASCI projects and organizations. The concern here is simply to profile the current capabilities, not to judge them against any artificial scale.

Associated with the CMM is a questionnaire [*3*] to be used in formal assessments. That questionnaire has been simplified by Daskalantonakis [*5*] and others for use in less formal contexts; it is more easily used for an organization’s self-assessment of its own practices. This reformed questionnaire [*9*] is the initial means for collecting assessment information from code teams.

The CMM serves as a valuable framework for structuring the raw survey information, for analyzing effectiveness of current practices for their purposes in the ASCI environment, and for integrating laboratory assessments into a uni-

fied view of tri-lab capabilities. In later considerations, it can serve as a broadly accepted basis for helping prioritize future improvements to code team and laboratory capabilities. Of course, any process changes made by ASCI organizations based on the assessment results from this survey should be evaluated for their appropriateness in the ASCI context.

2. 3 Issues

There are several concerns and constraints to be addressed in this plan. These issues are identified here. The plan accounts for all these issues in Section 2.4.

2. 3 1 Tri-lab representation in the process

All ASCI laboratories are expected to have representatives on the Tri-Lab Assessment Team (A-Team). This direct participation

- will enhance communication between the organizations and the Assessment Team, and
- will ensure the overall survey process is as agreeable and responsive as possible to local concerns and constraints.

In addition, each laboratory will designate a Site Coordinator to work directly with the A-Team for all local arrangements.

Personnel from Idaho National Engineering and Environmental Laboratory (INEEL) will observe all tri-lab survey activities for evaluating the survey process itself.

2. 3 2 INEEL participation

At the direction of the Deputy Assistant Secretary for Strategic Computing and Simulation in the Office of Defense Programs, INEEL is to provide Independent Verification and Validation support of other ASCI Validation and Verification efforts. The Tri-Lab Survey of Software Engineering Practices is one such effort. INEEL is independent in that it is not within the Weapons Complex and has no stake in the outcome of the tri-lab survey project. In this effort, INEEL will report to the DOE ASCI V&V Program Manager.

INEEL will be an independent observer of the survey process. This observer role participates in two separate feedback loops.

- INEEL will provide real-time and post-mortem feedback to the assessment team during and after each assessment.
- INEEL will monitor the survey process and evaluate its objectivity and credibility. Results of this observation and evaluation will be documented in a separate Tri-Lab Survey Assessment Report.

An indirect benefit of INEEL participation in this role will be the enhancement of their ASCI knowledge. This will facilitate other Independent Validation and Verification activities they may perform in the future for the ASCI program.

2. 3 3 Confidentiality

Confidentiality includes both the concerns of data security as well as those of participant privacy. Data security concerns are met with security clearance

and “need to know” requirements on all Assessment Team members. Privacy concerns are satisfied through a confidentiality agreement which requires a careful cleansing of individual and organizational identities from all released information, and a rigid adherence to specific policies on information ownership and release.

The survey is reported in a series of carefully controlled final reports whose release is severely restricted for reasons of confidentiality. These reports are designed to satisfy the several customers individually and to provide the appropriate aggregations of information which are most suitable for each customer. A Code Team Assessment Report will not attribute any information to any individual, nor will it contain any information that is confidential to any other code team. Similarly, a Laboratory Assessment Report will not attribute any information to any individual or code team, nor will it contain any information that is confidential to any other laboratory. The Tri-Lab Survey Report will not attribute any information to any individual, code team, or laboratory source. Such an approach is fundamental to achieving accuracy and usefulness in the survey results.

2. 3 4 Training on the survey method

All Assessment Team members will be trained on the mechanics of the survey. This is necessary to ensure all members of the team are familiar with all policies, working materials, and procedures for the following :

analyzing responses to the standard questionnaire,

interviewing FAR groups

evaluating process evidence

extracting relevant assessment information from interview transcripts.

The training is in two parts. The first is a one-day workshop for the entire Assessment Team, to be held before laboratory assessments are begun. The second is a review session to prepare the Assessment Team for the specific laboratory assessment and ensures last-minute details are covered.

2. 3 5 Use of survey results

The survey results will establish a baseline description of the software engineering practices being used within code teams, within laboratories, and within the DOE ASCI V&V Program.

Code Team Assessment Report.

Survey results describing a code team’s current software engineering practices are delivered to the ASCI Code Team Lead for the code team’s benefit. Those results may focus on-going process improvements to greater benefit, or they may suggest new areas for potential improvements in the team’s software engineering practices.

Laboratory Assessment Report.

Survey results describing the kinds of software engineering practices used in the laboratory, as well as the current extent, rigor, and support of those practices, is delivered to the Laboratory ASCI V&V Executive Council Rep-

resentative for the laboratory's benefit. Those aggregate results can be used to identify systemic strengths and problems within the laboratory. This analysis allows the identification of opportunities to leverage existing capabilities into additional code teams that could benefit from them. It also allows the identification of common problems that may be reduced or eliminated by applying laboratory-wide resources to their solution.

Tri-Lab Survey Report.

Survey results describing kinds of software engineering practices used in the ASCI laboratories, as well as the current extent, rigor, and support of those practices, is delivered to the DOE ASCI V&V Program Manager. Those aggregated results can be used to identify systemic strengths and problems in the ASCI program as a whole. This analysis allows the identification of existing capabilities that should be supported and deployed where appropriate. It also allows the identification of common problems that may be reduced or eliminated by applying program-wide resources to their solution. Finally, the survey results document just how extensive is the grounding of ASCI on software engineering practices; this may assist the DOE ASCI management in responding to questions from the DOE Secretary or to congressional inquiries.

Tri-Lab Survey Assessment Report.

The independent survey assessment is also delivered to the DOE ASCI V&V Program Manager. By analyzing the conduct of the survey process, it provides evidence for the objectivity and credibility of the reported survey results. It is expected to motivate both decisions and actions for continuing support of good software engineering practices in ASCI.

Using the survey results, the Laboratory ASCI V&V Program managers and Code Team Leads can decide where to apply their resources to increase the effectiveness of the ASCI efforts. With a baseline of those practices currently being employed, coupled with an understanding of the engineering practices important to ASCI, resources can be applied in specific areas to provide a valuable return-on-investment.

Identifying what software engineering practices are "important" requires a more detailed understanding of the desired characteristics of ASCI code work products. General goals for ASCI codes are obvious - timely, accurate, reliable, adaptable, supportable, usable by analysts and designers, and qualified for application - but these cannot all be achieved to everyone's satisfaction at the same time. Rather, one must translate these general goals into specific properties of the code, balance their achievable values, and apply that result to determining the most effective extent and rigor of software engineering practices to be used.

The results of this survey should support further work on defining software quality for ASCI codes.

2. 4 Activities and Responsibilities

The major activities required for implementing this tri-lab survey are essentially sequential in their intended execution.

1. Assessment Team formation

2. Assessment Team training
3. Individual laboratory assessments
4. Tri-Lab Survey Report preparation

2. 4 1 Assessment team formation

2. 4 1 1 Purpose

A Tri-Lab Assessment Team with members from each of the ASCI laboratories will be formed for the purpose of this survey. One Primary Assessor and one or more Alternate Assessors will be selected by each laboratory's ASCI V&V Executive Council Representative in accord with the guidelines below. Following the guidance in the originating request for this survey, the Lead Assessor for the survey will be provided from the SNL Quality Engineering Department software team. The Primary Assessors and the Lead Assessor compose the Assessment Team (A-Team). An A-Team with fewer than four members would have difficulty performing the planned laboratory assessments, but an A-Team with four members is both sufficient and cost-effective.

Variability in applying the assessment process is limited through several factors. First, the assessment process itself is well defined and repeatable [*4*].

Second, the plan intends for the A-Team to have a constant membership, insofar as possible. The Primary Assessors are selected with this intent. However, assessment scheduling is one of the most difficult parts of planning for a laboratory assessment. The Lead Assessor works with the Site Coordinator to schedule all of the activities and participants for each laboratory assessment. Every attempt will be made to arrange the laboratory assessments around the availability of the Primary Assessors. If that cannot be achieved, or if an already-established schedule is jeopardized by circumstances preventing the Primary Assessor's participation, then an Alternate Assessor will be substituted for a Primary Assessor. Having a single A-Team ensures a consistent approach for interviews, evidence reviews, and analysis at all assessed laboratories.

Third, training is planned to ensure an A-Team that is relatively homogeneous in its approach to software process assessment. All primary and alternate assessors will be trained in the full approach to producing the Tri-Lab Survey Report and in the detailed mechanics of the laboratory assessment method. In addition, the A-Team has an additional laboratory-specific training session prior to each laboratory assessment.

The approach described here is expected to provide sufficient repeatability of process and flexibility of scheduling to accomplish the survey as intended.

It may occur that the A-Team needs to increase its capability to understand and interpret specialized technology issues. An appropriate Alternate Assessor could be added to the A-Team to provide this capability.

2. 4 1 2 Guidelines

Tri-lab participation.

A Primary Assessor and one or more Alternate Assessors are required from each of LANL, LLNL, and SNL. Each assessor must have a DOE Q-clearance and may need approval for access to Restricted Data.

The SNL Quality Engineering Department software team will provide the Lead Assessor for the A-Team. The Lead Assessor must have a DOE Q-clearance and have approval for access to Restricted Data.

INEEL participation.

One or more independent process observers are required from INEEL. Only one observer will accompany the A-Team through a laboratory assessment. Process observers may be regarded as primary and alternate for the purpose of their assignment to the A-Team. Each observer must have a DOE Q-clearance and may need approval for access to Restricted Data.

Participant qualifications.

It is most desirable that an A-Team has the following qualifications [*4*]:

knowledge of CMM key process areas [*1,2*];

knowledge of CMM-based assessments [*4,5*];

knowledge of software process improvement methods;

experience in various software engineering disciplines;

experience in software management;

experience various life cycle activities and functions; and

familiar with the development of large scientific and engineering codes.

The Lead Assessor is responsible for ensuring the A-Team members meet these qualifications, and will assist the ASCI V&V Executive Council Representative in selecting appropriate primary assessors.

2. 4 2 Assessment team training

2. 4 2 1 Purpose

Primary and Alternate Assessors must participate in the A-Team training sessions. The training consists of a one-day comprehensive training session before any laboratory assessments and a half-day training/review session.

The one-day comprehensive training session will ensure assessors understand the assessment process, analysis methods, report generation, and confidentiality rules. The training will be conducted by Sandia Quality Engineering Department software team personnel and held at Sandia. The specific time and location of the one-day training session will be coordinated with the assessment team participants.

The half-day training/review session will be conducted before (or perhaps during the first part of) a laboratory assessment. This session provides final coordination of the laboratory assessment roles, schedule details, and laboratory functional area representative interview group information. This session may be conducted through teleconference or other methods as determined by the A-Team participants.

2. 4 2 2 One-day training session format

The entire pool of candidates for Primary and Alternate Assessors will participate in an A-Team training session. An outline of the training session consists of five parts as indicated below. Although the assessment process is based on

the Software Engineering Institute (SEI) Capability Maturity Model (CMM) [*1,2*], this model will only be briefly covered in the training session. It will be described only insofar as it is represented in the questionnaire used to solicit each code team's self-assessment responses [*9*]. The general structures of a software process assessment, as developed by SEI and evolved through extensive industry application, will be described. Most of the sessions will consist of short presentations followed by hands-on workshop activities.

1. Orientation
   Participant introduction and background
   Objectives of the training session
   Assessment process overview
   Assessment of the assessment process overview
   General confidentiality issues
2. Pre-assessment phase activities
   Team roles: lead assessor, other assessors
   Interactions with the site coordinator
   A-Team review session
   Questionnaire response analysis and scoring system review
   Project profiles review
   Project evidence review
   A-Team confidentiality agreement
3. Assessment phase activities
   In-briefing
   FAR group interviews
   FAR group analysis sessions
   Out-briefing preparation
   Out-briefing dry run
   Out-briefing presentation
   Interview data, analysis data, presentation materials confidentiality issues
4. Post-assessment phase activities
   Preparation of laboratory and code team assessment report drafts
   A-Team report review (inspection process)
   Report distribution (laboratory and code teams)
   Report and analysis data confidentiality issues
5. Baseline survey report preparation
   Format
   Analysis approach
   Preparation
   Distribution
   Report and analysis data confidentiality issues

2. 4 2 3 Format for laboratory-specific review session

A-Team members will participate in a review session before (or at the start of) the site activities of each assessment. The purpose of this half-day review session is to prepare the A-Team for the specific laboratory assessment and to ensure last-minute details have been covered. This review will cover the following areas:

1. Laboratory assessment organization
   ASCI code teams involved in the assessment
   Functional Area Representative (FAR) groups & participants
   FAR group questions (perhaps tailored from general set to be laboratory-specific)
   A-Team roles
   Daily Schedule
2. Laboratory assessment preliminary evidence review (as available)
   ASCI code team profile sheets
   ASCI code team questionnaire responses and listed evidence
   General review of potential issues, completeness, anomalies
3. Action items and responsibility assignments
   FAR group leaders
   Analysis
   In- & out-brief presentations

2. 4 2 4 Instructors, location, and schedule

Members of the Sandia Quality Engineering Department software team will conduct the one-day training session. The date and location is specified in Appendix B.

Members of the Sandia Quality Engineering Department software will conduct the laboratory review sessions. The date and location for each session will be determined by the Lead Assessor.

2. 4 3 Individual laboratory assessments

2. 4 3 1 Assessment phases

Each assessment has preparation, on-site, and follow up activities associated with it. See Section 3 for an overview of the laboratory assessment plan.

The assessments at LANL and LLNL will follow the generic plan for laboratory assessments.

The situation at SNL is a little different. Sandia has two geographically separate sites: Sandia/NM in Albuquerque, and Sandia/CA in Livermore. The work at each site will follow the generic plan for laboratory assessments. Each participating code team at each site will receive a Code Team Assessment Report, but only one Laboratory Assessment Report will be prepared for the SNL ASCI V&V Executive Council Representative.

2. 4 3 2 General guidelines

Selection of Laboratory Assessment Team for each site

The A-Team for each laboratory assessment will include the Lead Assessor and one assessor from each laboratory. The assessor from a laboratory will be the Primary Assessor, unless the Primary Assessor is replaced by an Alternate Assessor for that particular assessment.

There are some constraints on participation as an A-Team member:

the individual can not be a member or a customer of any of the code teams being assessed,

the individual can not be a manager of any of the code teams being assessed or within the direct supervisory chain of any of the anticipated interviewees, and

the individual must have completed the training identified in Section 2.4.2.

As far as possible, the Lead Assessor considers the availability of all laboratory assessors when determining the on-site assessment schedule.

Coordination with independent observers

INEEL will provide one process observer to accompany the A-Team and evaluate the laboratory assessment process. The Lead Assessor ensures INEEL observers are provided with current information throughout each laboratory assessment process. This includes the preparation, on-site assessment, and follow-up activities. Furthermore, the Lead Assessor considers the availability of observer personnel when determining the on-site assessment schedule.

Appointment of Site Coordinator

A Site Coordinator for each laboratory assessment is specified in Appendix B.

The Site Coordinator is a laboratory staff member who works with the Lead Assessor for planning and conducting a laboratory assessment. The Site Coordinator is responsible for all site logistics, to include scheduling, facilities, equipment, and meals.

The Site Coordinator works with the laboratory's ASCI V&V Executive Council Representative for selecting the participating code teams. The Site Coordinator also assists participating code teams in preparing their self-assessment responses to the standard questionnaire, in selecting FAR group members, and in collecting references to, or samples of, project materials.

Selection of participating code teams

All ASCI code teams at the Lawrence Livermore, Los Alamos, and Sandia laboratories are eligible to participate in the baseline survey.

The laboratory assessment is intended to focus on all technical and managerial practices affecting computational physics codes and selected support codes.

The Site Coordinator for each laboratory assessment will work with that laboratory's ASCII V&V Executive Council Representative to identify the code teams selected to participate in the assessment.

Selection of participating code team members

Each Code Team Lead will work with the Site Coordinator to select team members to participate in the site interviews. The selected individuals should be knowledgeable about the team's work environment and processes.

Selection of other interview groups

The Site Coordinator for each laboratory assessment will work with that laboratory's ASCII V&V Executive Council Representative to identify other program and technical management representatives to be interviewed. These may include Laboratory V&V Program Management personnel, analysts or designers who use ASCI codes, or other verification and validation personnel.

Confidentiality

All assessments and report preparation involve handling of sensitive or classified information. The policy for all privacy and security issues is described in Section 2.5.

2. 4 3 3 Document production standards

All deliverable documentation from the survey activity will be produced with Microsoft's MS Office 97 products.

All electronic document transfers will be accomplished in Rich Text Format (RTF) at the application level.

2. 4 4 Survey report preparation

After concluding all laboratory assessments, the Lead Assessor will reconvene the A-Team. The team will review and analyze the results contained in the Laboratory and Code Team Assessment Reports for commonalties, accomplishments, and opportunities for improvement observed across the ASCI laboratories in their software engineering practices. The results will be aggregated into an inclusive summary of tri-lab practices and reviewed by the Laboratory ASCI V&V Executive Council.

A final Tri-Lab Survey Report will be prepared and delivered to the DOE ASCI V&V Program Manager and each Laboratory ASCI V&V Executive Council Representative. At their request, a briefing on the report contents may be given.

2. 5 Confidentiality and Information Management

Confidentiality is extremely important in order for the baseline survey and laboratory assessments to achieve their objectives. It is critical that each participant in this survey process understands the confidentiality issues and protection methods. This section provides a basis for that understanding. The guiding principle is that participants will have access only to that assessment information as appropriate for them. The sharing of assessment information in

any form is controlled by the confidentiality constraints indicated below.

2. 5 1 A-Team security clearance

All A-Team members are required to have Q clearances.

No discussions, collected assessment data, or reports are intended to be classified, but there may be discussion of such information during the assessment process. Also, some process evidence that is reviewed by the A-Team may be classified, but no known classified information should be recorded. Every attempt will be made to keep the A-Team's data and reports unclassified

There may be laboratory-specific "need to know" constraints on A-Team members, such as needing approval for access to Restricted Data. Where such additional requirements are present, the Lead Assessor and Site Coordinator will arrange for the A-Team to satisfy the requirements.

The A-Team will follow all DOE policies for handling and discussing classified material.

2. 5 2 Confidentiality of survey information

For each laboratory assessment, the A-Team and the independent process observer will sign a confidentiality agreement [*10*]. This agreement is to be completed before the laboratory assessment begins and it states that confidentiality will be observed outside of the assessment process by all A-Team members. The intent of this agreement is to shield from inappropriate disclosure the identity of any person, code team, or laboratory providing information to the A-Team in the course of the survey process. This protection applies to all spoken or written communications of A-Team members with anyone outside the A-Team.

The confidentiality agreement can be tailored for laboratory-specific concerns, but its purpose is to establish the following principles of operation.

Only composite results are given in any report. This applies at each level of information aggregation. The Code Team Assessment Report will be delivered to the Code Team Lead. This report will not have any attribution to specific individuals in the code team. The Laboratory Assessment Report will be delivered to the laboratory's ASCI V&V Executive Council Representative. This report will not have any attribution to specific ASCI code teams or individual participants in the laboratory.

After all ASCI laboratory assessments are complete, a composite Tri-Lab Survey Report will be delivered to the DOE ASCI V&V Program Manager and to the other members of the ASCI V&V Executive Council. This report will not have any attribution to specific ASCI laboratories, ASCI code teams, or individual participants.

Every delivered report has only one recipient, called the copy controller, with the authority to make and distribute copies of the report. Specific observations and conclusions (reports, slides, etc.) are shared only by the discretion of that person. All reports will be marked with appropriate disclosure and distribution labels.

Assessment data (including notes, analysis information, and final reports) will be retained by the A-Team Lead Assessor, but will not be shared with anyone else. Any attribution of information to any individuals will be

removed from the data or the data destroyed as appropriate after all ASCI laboratory assessments are complete.

Other assessment participants, including code team members and leads, project managers, and other Functional Area Representatives, should observe similar constraints on the discussion of any assessment information. No participant's comments should ever be identified outside an interview session.

2. 5 3 Report sensitivity, marking, and review

2. 5 3 1 Approach for unclassified assessment information

In order to prevent inadvertent release of sensitive information, all assessment information will normally be considered as unclassified and confidential, to be marked for appropriate disclosure and distribution control. In order to prevent inadvertent release of classified information, various assessment materials may also be subjected to classification reviews before their removal from their point of origin. The intent is to prevent the recording of classified information and to protect the confidentiality of all assessment information from possible release. All such reviews and markings will be determined during the detailed planning for each laboratory assessment. To the extent possible, no assessment deliverable will be classified.

Project profile sheets [*8*] and pre-assessment responses to the standard questionnaire [*9*] should not contain classified data, but they may reference classified data.

Classified ASCI code products may be shown to the A-Team, although it is not intended that classified information pertaining to such codes be provided by any laboratory employee during site interviews. Before participation in any laboratory assessment activities, A-Team members and FAR group members should be reminded of their security obligations to ensure compliance with this policy.

The Site Coordinator should ensure all project profiles and questionnaire responses are unclassified. They will be appropriately marked for disclosure and distribution control and will be retained by the Lead Assessor for the duration of this Tri-Lab Survey project. Upon termination of the survey project, they are returned to the Code Team Leads who may keep or dispose of them as desired.

All assessment team members will record all interview and evidence review notes in a notebook issued to them by the Site Coordinator. At the conclusion of each laboratory assessment, these notebooks may receive a classification review to ensure all information is unclassified prior to removal from the laboratory. The notebooks will be transferred in their entirety to the Lead Assessor. They will be appropriately marked for disclosure and distribution control and will be retained by the Lead Assessor for the duration of this tri-lab survey project. Upon termination of the project, all raw data will be shredded.

Before any report is distributed, it will be reviewed by an appropriate laboratory Classification Officer to ensure it contains no classified information and it is properly marked for disclosure and distribution control. To the extent possible, all Code Team Assessment Reports, Laboratory Assessment Reports, and the Tri-Lab Survey Report shall be unclassified. A master copy of each report will be retained by the Lead Assessor.

2. 5 3 2 Approach for classified assessment information

In some cases, it may be necessary for classified information to appear in project profile sheets, responses to the standard questionnaire, team member notebooks, Code Team Assessment Reports, or Laboratory Assessment Reports. The following modifications to the approach in Section 2.5.3.1 are required.

Materials will be marked with their classification status.

Removal and transport of classified materials will be in accord with DOE requirements on physical and electronic transmissions.

Storage of classified materials by Lead Assessor will be limited to one (1) year following submission of the Tri-Lab Survey Report to the DOE ASCI V&V Program Manager.

2. 5 4 Information management control

Three roles are defined for protecting the confidentiality of survey information. These roles are Ownership, Distribution, and Copy Control.

Ownership

Ownership indicates who is responsible for the collection and protection of an information asset from inappropriate disclosure.

Distribution

Distribution indicates the intended receiver(s) of an information asset that is subject to disclosure protection.

Copy Control

Copy Control indicates the sole authority for external release of the information asset to anyone not listed for Ownership or Distribution for that information asset.

The following tables provide a summary of the assignment of Ownership, Distribution, and Copy Control responsibilities for ASCI assessment information.

Interview and evidence review data

Ownership	Lead Assessor
Distribution	None
Copy Control	Shredded at project termination

Code Team Assessment Report

Ownership	Lead Assessor
Distribution	Code Team Lead
Copy Control	Code Team Lead

Laboratory Assessment Report

Ownership	Lead Assessor
Distribution	Code Team Lead Laboratory ASCI V&V Executive Council Representative
Copy Control	Laboratory ASCI V&V Executive Council Representative

Tri-Lab Survey Report

Ownership	Lead Assessor
Distribution	Laboratory ASCI V&V Executive Council Representative ASCI V&V Executive Council Chair
Copy Control	ASCI V&V Executive Council Chair

Tri-Lab Survey Assessment Report

Ownership	Process Observer
Distribution	Lead Assessor Laboratory ASCI V&V Executive Council Representative ASCI V&V Executive Council Chair
Copy Control	ASCI V&V Executive Council Chair

It is expected that the ASCI V&V Executive Council Chair will provide copies of the Tri-Lab Survey Report and Survey Assessment Report to the Laboratory

ASCI Program Managers. *The confidentiality agreements preclude such a distribution by the Assessment Team.*

Except for this notice, this page has no content

3. PLAN FOR LABORATORY ASSESSMENTS

3. 1 Personnel

The Assessment Team (A-Team) is formed according to the guidelines in Section 2.4.1.2. Its members and alternates are specified in Appendix B.1.

3. 2 Activities

3. 2 1 Preparation

The following activities must have been completed before starting a laboratory assessment. These activities may consume considerable time. Primarily they involve the Lead Assessor and the Site Coordinator. Code Team Leads are involved in some of the planning, but their expertise is required for responding to the standard questionnaire [*9*] about the scope and rigor of the code team's software engineering practices.

A-Team is trained in the assessment process.

Lead Assessor meets with Site Coordinator to organize the assessment activities for that site. They adapt the assessment materials, as needed, to map compatibly to local concepts and vocabulary, thereby eliminating erroneous results because of misunderstandings about software engineering practices.

A-Team conducts orientation meetings with Code Team Leads and staff to introduce them to the assessment process and the A-Team.

Site Coordinator determines which code teams are to participate in the assessment. The Site Coordinator and each participating Code Team Lead also determine which code team members are to participate in the on-site assessment interviews.

Each code team to be interviewed completes the code team profile sheet [*8*]. Each participating code team also responds to the standard questionnaire [*9*], with Site Coordinator assistance, and identifies appropriate process evidence to support that response.

Lead Assessor ensures preparation of in-briefing materials, analysis spreadsheets, interview checklists, and templates for the out-briefing and final report.

A-Team reviews code team profile sheet and self-assessment responses to the standard questionnaire and updates interview checklists.

Lead Assessor and Site Coordinator document the Laboratory Assessment Plan.

3. 2 2 On-site assessment

The on-site assessment consists of the following activities.

Lead Assessor conducts an in-briefing to all laboratory assessment participants detailing the activities of the assessment week.

A-Team may receive a laboratory-specific security briefing (may occur during preparation phase).

A-Team conducts code team interviews, analyzes interview comments against SEI's CMM key process areas, and reviews evidence to support software engineering practices.

A-Team compiles all information collected into strengths and areas for improvement for each code team interviewed and for the laboratory ASCI as a whole.

Lead Assessor reviews a draft out-briefing of assessment results with the ASCI V&V Executive Council Representative and Code Team Lead participants. Comments are integrated into the out-briefing prior to its presentation.

Lead Assessor presents an out-briefing to all laboratory assessment participants outlining the results for the laboratory.

3. 2 3 Follow-up

The assessment follow-up consists of the following activities.

A-Team produces a final report with detailed description of the assessment results for the laboratory. This Laboratory Assessment Report is delivered to the laboratory's ASCI V&V Executive Council Representative; this report provides confidentiality for all code teams and individuals participating in the assessment.

A-Team produces an appendix for each code team interviewed with detailed description of the assessment results for the code team. This appendix is combined with the Laboratory Assessment report and delivered to the ASCI Code Team Lead; this report provides confidentiality for individuals participating in the assessment.

3. 3 Generic Schedule

This section provides an overview of the generic schedule for the preparation and on-site activities. Detailed schedules for each assessment will be prepared by the Lead Assessor and the Site Coordinator before beginning the assessment work at a laboratory.

3. 3 1 Preparation schedule

Proper preparation for the laboratory assessment is critical to the overall success of the assessment. Tasks that should be addressed starting about 60 days before the assessment week include:

Select A-Team participants

Select Site Coordinator

Conduct training of A-Team, if required

Finalize laboratory assessment materials: code team profile sheets, confidentiality agreement, laboratory self-assessment questionnaire, laboratory assessment checklist

Provide Site Coordinator with laboratory assessment materials

Tasks that should be addressed starting about 45 days before the assessment week include:

Hold planning meeting with Site Coordinator and A-Team

Reserve conference rooms needed for laboratory assessment week

Tasks that should be addressed starting about 30 days before the assessment week include:

Hold assessment orientation meetings

Sign confidentiality agreements with Code Team Leads and the ASCI V&V Executive Council Representative

Finalize laboratory assessment schedule

Tasks that should be addressed starting about 10 days before the assessment week include:

Complete laboratory self-assessment questionnaires, including list of available evidence

Return completed code team profile sheets, laboratory self-assessment responses to the standard questionnaire, and available evidence to Lead Assessor

Determine Functional Area Representative (interview) groups

Prepare Interview Checklists

Tasks that should be addressed starting about 5 days before the assessment week include:

Send reminder to all assessment participants of laboratory assessment schedule

Prepare In-Briefing and templates for Out-Briefing and Final Report

3. 3 2 On-site assessment schedule

A generic schedule for the on-site portion of a laboratory assessment is given in Table 1: Generic Schedule for on-site assessment below. The actual duration and schedule for the on-site activities depends on the number of interview groups and scheduling constraints of the participants.

Table 1: Generic Schedule for on-site assessment

	Day 1	Day 2		Day n	Day n+1
AM	In-Briefing Meeting 8:30-9:30 ASCI Program Mgmt Interview 9:30-11:00 Interview Analysis 11:00-12:00	Code Team Interview 8:30-10:30 Interview Analysis 10:30-12:00	■ ■ ■	Out-Briefing and Laboratory Report Preparation 8:30-11:30	Out-Briefing - Mgmt 9:00-10:00 Out-Briefing - All 10:00-11:00
PM	Code Team Leads Interview 1:00-3:00 Interview Analysis 3:00-4:30 Mgmt Evidence Review 4:30-5:30	Code Team Evidence Review 1:00-3:00 Assessment Analysis 3:00-4:30	*Repeat Day 2 for each code team to be interviewed*	Out-Briefing and Laboratory Report Preparation 1:00-4:30	
	At the end of this day, a management perspective of ASCI software engineering activities should be surveyed.	*At the end of this day, the code team report should be nearly complete.*		*At the end of this day, the laboratory report should be nearly complete.*	

3. 3 3 Materials

The materials used to support all activities described in Section Activities are listed in Table 2 below.

Table 2: Materials and Responsibilities for Laboratory Assessment

Material	Description	Responsibility
Laboratory Assessment Plan	Planning information for the Site Coordinator and Lead Assessor	Site Coordinator Lead Assessor
Self-Assessment Questionnaire	Self-evaluation of code team's software practices based on SEI CMM key process areas	Site Coordinator Code Teams
Code Team Profile Sheets	Description of Code Team activities and participants	Code Team Lead
Confidentiality Agreement	Guarantee by A-Team to protect not only all information obtained during the assessment but also the sources of information	A-Team Process Observer
Evidence	Code Team and/or ASCI program documentation of software engineering practices that support activities in the SEI CMM key process areas	Code Teams
Assessor Notebooks	A notebook is issued to each assessor on the A-Team for recording all notes during the assessment. Upon conclusion of the site visit, all notebooks are collected by the Lead Assessor and protected according to the confidentiality and information management policy, and applicable classification status.	A-Team Lead Assessor
Final Report	Detailed documentation of the entire assessment including the assessment results	A-Team
In-Briefing	Presentation overview of assessment process	Lead Assessor
Interview Analysis Spreadsheet	Spreadsheet for collecting and analyzing assessment results	A-Team
Interview Checklist	Checklist of questions and areas to cover during each Code Team interview.	A-Team Lead Assessor
Out-Briefing	Presentation overview of assessment results	Lead Assessor
SEI CMM v1.1	Reference material for interpreting self-assessment responses to Questionnaire	A-Team Site Coordinator

3. 3 4 Results

The Laboratory Assessment Report and all Code Team Assessment Reports (i.e., appendices to the Laboratory Assessment Reports) are expected to be delivered to the designated recipients approximately two calendar weeks following the end of on-site activities.

A APPENDIX: MEMO FROM GIL WEIGAND

Deputy Assistant Secretary for Strategic Computing and Simulation
Office of Defense Programs in the Department of Energy

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Date:	Sun, 13 Dec 1998 15:49:18 -0500	

Subject: Baseline Survey of Software Quality Practices within ASCI

I would like your cooperation with the ASCI Tri-Lab baseline survey of software quality practices being employed to support the ASCI code development activities. This is a first step in implementation of our V&V program, and the goal is to support future improvements in our software development processes.

All ASCI applications code teams are required to participate in the baseline survey. I am asking Sandia to lead the program, but each laboratory will be an equal partner and will provide participants for the assessment team. I am also asking the Idaho National Engineering and Environment Laboratory (INEEL) to serve as an independent assessor of the process.

The survey leader will be Sandias[*sic*] Michael Blackledge (mablack@sandia.gov, 505-845-8307). Mike will develop a survey implementation plan in cooperation with the other laboratory partners. The implementation plan will document the general survey approach, process steps, training required, confidentiality and classification, and site survey schedule. I have asked Mike to ensure that the survey process has minimal impact on code development activities.

All site surveys should be conducted during the period from January through April of 1999. The survey team will provide a final report of their findings to me by April 30, 1999.

Except for this notice, this page has no content

B APPENDIX: TRI-LAB SURVEY PHASES

B 1 Assessment Team Formation

The Assessment Team comprises the following members:

Lead Assessor	SNL, Patty Trellue
LLNL Assessor, primary	Nancy Storch
LLNL Assessor, alternate(s)	Warren Persons Booker Thomas
LANL Assessor, primary	Skip Egdorf
LANL Assessor, alternate(s)	Gary Clark Jonathan Parker Elsie Sandford
SNL Assessor, primary	Dave Peercy
SNL Assessor, alternate(s)	Dwayne Knirk

The tri-lab survey process is observed and evaluated by INEEL. One process observer accompanies the A-Team to each laboratory assessment.

INEEL Observer, primary	Dennis Adams
INEEL Observer, alternate(s)	Nyle Brown

B 2 Assessment Team Training

One-Day Training Session

Instructor(s)	Members of SNL Quality Engineering Department
Date	Tuesday, December 15, 1998
Location	DOE Energy Training Complex (ETC), Albuquerque, New Mexico

Laboratory-Specific Review Session

The location and schedule for the laboratory-specific review session will be

determined by each site A-Team.

B 3 Individual Laboratory Assessments

There are three laboratories and four geographic sites to be assessed. Initial target dates for laboratory assessments are given in the following table.

1 Feb – 12 Mar, 1999	LANL
15 Mar – 9 Apr, 1999	SNL / CA SNL / NM
12 Apr – 14 May, 1999	LLNL

The Site Coordinator, the V&V Executive Council Representative, and the ASCI Program Manager for each laboratory are listed here.

	LANL	LLNL	SNL
Site Coordinator	*Gerald Reisz* *Maysa Peterson*	*Nancy Storch*	*NM: Dave Peercy* *CA: Juan Meza*
ASCI V&V Executive Council Representative	*Mike Jones*	*Cynthia Nitta*	*Jaime Moya*
ASCI Program Manager	*Don McCoy*	*David Nowak*	*Paul Hommert*

B 4 Tri-Lab Survey Report Preparation

The Tri-Lab Survey Report is prepared after all the laboratory assessments have been performed and their reports delivered. An initial target date for the final reports is given in the following table.

2 Jul, 1999	Tri-Lab Survey Report on software engineering practices
2 Jul, 1999	Tri-Lab Survey Assessment Report on the survey process

The survey report is prepared by the A-Team, while the survey assessment report is prepared by the independent process observer. Detailed logistics for

the A-Team's work are needed to cover aggregation analysis, report writing and review activities.

The Tri-Lab Survey Report and the Survey Assessment Report are delivered to the DOE ASCI V&V Program Manager and the members of the ASCI V&V Executive Council.